DCGS-A — Lessons Learned Developing the Army's Premier Intelligence, Surveillance and Reconnaissance (ISR) Platform

COL Henry E. Abercrombie

Enterprise: (a) a project undertaken or to be undertaken, especially one that is important, difficult or that requires boldness or energy, (b) a plan for such a project, or (c) participation or engagement in such projects.

— Dictionary.com Unabridged (v 1.1)

DCGS-A's SOA will better support Soldier tactical requirements and provide military intelligence analysts unprecedented access to diverse databases and advanced analysis tools. Here, SPC Victor Ramos (left) and SSG George Castro from Bravo Co., 1st Battalion, 23rd Infantry Regiment, 2nd Infantry Division, gather information following a residential raid of a suspected insurgent in Baghdad, Iraq, Feb. 6, 2007. (U.S. Army photo by SGT Tierney P. Nowland.)

The preceding definition accurately describes not just the Distributed Common Ground System-Army (DCGS-A), but also the process by which it has been undertaken and managed. Other articles in this magazine will discuss the architecture, specific program technology, military intelligence, strategic import and DCGS-A's use in operational art. This article is intended to review for program managers in DOD and civilian agencies, who are building enterprise systems, some techniques we used in DCGS-A. Let me begin by defining DCGS-A and its supporting concepts. After these points are discussed, I will provide observations gathered from delivering each initial execution's component of the DCGS-A enterprise.

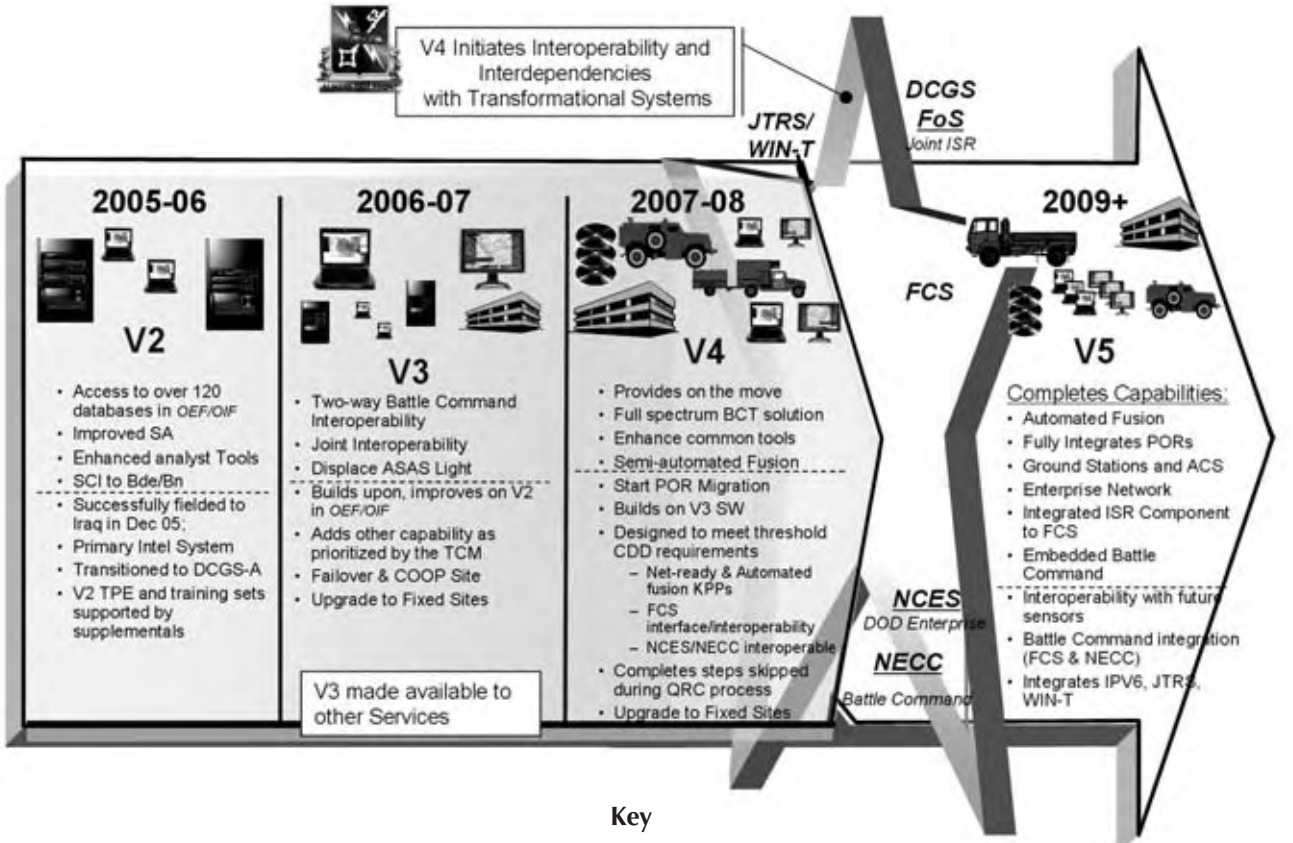
DCGS-A Definitions

DCGS is a family of fixed and deployable multi-source ground processing systems that support a range of ISR systems such as national or commercial satellite systems and unmanned aerial systems. DCGS, when fully operational, will provide continuous on-demand intelligence brokering to achieve full-spectrum dominance so that American and coalition forces can change the course of events in hours, minutes or seconds. The environment provides physical and electronic distribution of ISR data, processes and systems, as illustrated in the figure on Page 10.

The Army's contribution — and a key DCGS component — is DCGS-A. DCGS-A is the Army's enterprise platform for ISR. DCGS-A's objective is to integrate in a seamless enterprise 10 Programs of Record (PORs) that comprise the bulk of the Army's ISR capabilities.

Managing Paradigm Shift

DCGS-A's development has not been as much a technical challenge as one of changing the philosophical and operational context of the way ISR platforms



Key

ACS – Aerial Common Sensor
ASAS – All Source Analysis Platform
BCT – Brigade Combat Team
Bde/Bn – Brigade/Battalion
CDD – Capabilities Development Document
COOP – Continuity of Operations
FoS – Family of Systems
IPV6 – Internet Protocol Version 6
JTRS – Joint Tactical Radio System
KPP – Key Performance Parameter
NCES – Net-Centric Enterprise Services
NECC – Net-Enabled Command Capability
OEF – *Operation Enduring Freedom*
OIF – *Operation Iraqi Freedom*
QRC – Quick Reaction Capability
SA – Situational Awareness
SCI – Sensitive Compartmented Information
SW – Software
TCM – U.S. Army Training and Doctrine Command (TRADOC) Capabilities Manager
TPE – Theater Provided Equipment
WIN-T – Warfighter Information Network-Tactical

DCGS-A Development Evolution

are designed, developed, implemented and, ultimately, acquired. Transformation has recently become a very popular phrase in DOD organizational concepts. In managing enterprise system development, the critical question in transformation, or of going from an Industrial Age to an Information Age military, is the objective quantification of the value that distributed, networked forces bring to modern combat.

This networked or enterprise question is not uncommon in commercial information technology (IT) projects that require the upgrading or transitioning of legacy systems to a more modern system execution. In that context, the calculus of return on investment is much more sharply defined than in the one DCGS-A exists in. The additional challenge in the DCGS-A program was the need to explain to and align the stakeholders with the new vision while also gaining their confidence as to its technical basis and capabilities. Each POR had its own prime contractor(s), management structure and constituency. Future Combat Systems (FCS) and our Joint service partners that were dependent on some of our sensors for mission requirements were also key factors in our development strategy. In order for the net-centric, implementation DCGS-A Joint vision to prevail, the Project Manager (PM) DCGS-A had to convince each group of two things. The first was that the essential value/contribution of their individual program would be effectively leveraged and, the second, was that the DCGS-A architecture would yield a system that was greater than the "sum of its parts" to combatant commanders and their Soldiers.

At PM DCGS-A, we developed a technical program management philosophy that was broad in its applicability and focused in operational execution. This overall philosophy was derived directly from the program name. We were looking for a truly distributed system that leveraged the capability of common elements and would not lock the Army into a costly proprietary solution. It was important that we not make the same mistakes pointed out by Jeff Cares in his book, *Distributed*

Networked Operations (*Foundations of Network Centric Warfare*). His key observation: "The military community often confuses IT-enhanced, rarefied Industrial Age processes with distributed networked systems that are truly transformed for the Information Age." The lessons learned from DCGS-A's successful development to date can help future practitioners to distinguish between these two and to manage the rapid development of a truly transformed "distributed enterprise."

Managing Legacy System to Enterprise Transformation

The plan for developing the DCGS-A enterprise was straightforward and based on a sound acquisition strategy. The key strategy in controlling costs and mitigating risks involved modifying the existing PORs so that they were enterprise-enabled in a concretely measurable fashion. This was done using these acquisition strategy steps and can be widely applied to any similar situation:

- Web-enable each POR to the fullest extent possible. This can start with something as simple as identifying a uniform resource locator hypertext endpoint for the functionality. From this starting point, use differing levels of sophistication all the way up to a Representational State Transfer or full Web service.
- Enforce data-level interoperability through the use of wrappers and adapters following a wrap-and-adapt strategy. These wrappers or adapters would be designed to conform to interoperable specifications. The infrastructure supporting these should be message-based with, at the lowest level, appropriate application program interface.
- Make widespread use of eXtensive Markup Language (XML) tagging and construct a meta-data capability.
- When able, use the service-enabling infrastructure of the DOD-proven DCGS Integration Backbone (DIB).

Determine What Enterprise Components Already Exist

Most programs start with a defined single-service requirements set. DCGS-A, as is the case in all enterprise projects, had a set of requirements derived from the DCGS-A Capabilities Development Document that encompassed the aggregated select number of individual requirements from each of the individual PORs along with other intangible stakeholder requirements that are part of most organizations' enterprise vision. Therefore, the first step was to inventory each POR's relevant capabilities and map them against an enterprise infrastructure that ensured the functionality covered was complete. Additional considerations between a standard DOD acquisition process and DCGS-A is that the DCGS-A program had an immediate operational deployment window it had to meet and that the system would be initially put together at a government-owned Systems Integration Laboratory (SIL). This operational fielding window was routinely accelerated from the originally stated program delivery schedule to meet operational rotation requirements and the overall Army Force Generation commitments. The SIL concept yielded advantages as it accelerated our ability to integrate new technologies. The most critical lesson was to immediately address how to inventory the data, spot redundancies and evaluate this inventoried dataagainst several factors. The data inventory process consisted of conducting a series of Soldier characterization user studies and tool surveys and engaging government,

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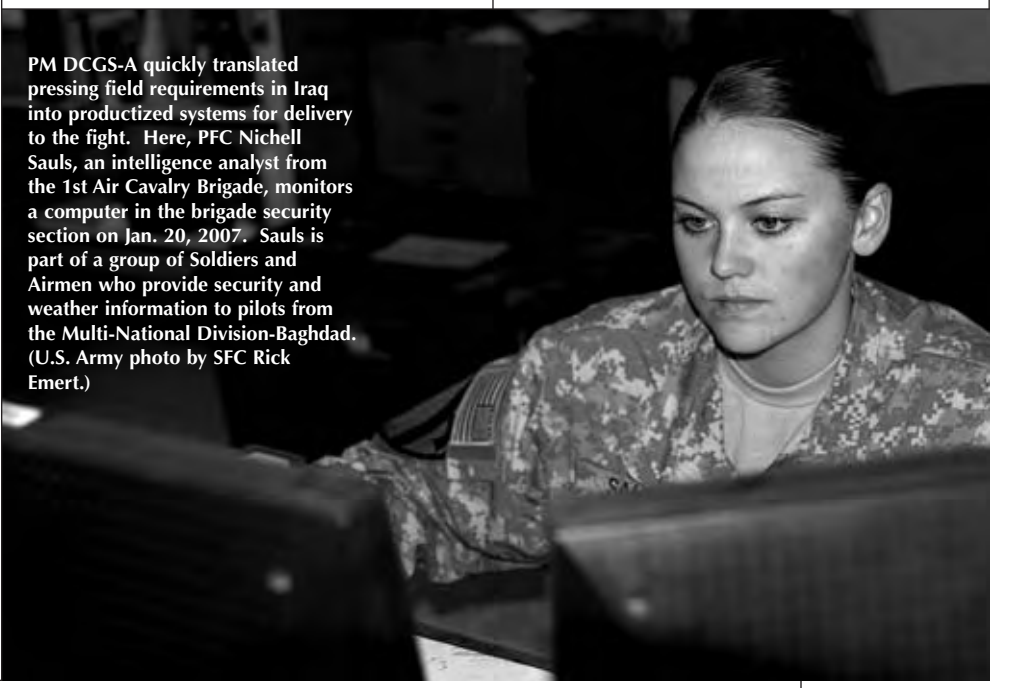

PM DCGS-A quickly translated pressing field requirements in Iraq into productized systems for delivery to the fight. Here, PFC Nichell Sauls, an intelligence analyst from the 1st Air Cavalry Brigade, monitors a computer in the brigade security section on Jan. 20, 2007. Sauls is part of a group of Soldiers and Airmen who provide security and weather information to pilots from the Multi-National Division-Baghdad. (U.S. Army photo by SFC Rick Emert.)

as well as civilian, subject matter experts in each program.

The next step was to map the user (consumer research in a commercial environment) against a workable system model. Because DCGS-A is primarily an aggregated software system, the unified model used was the model/view/controller pattern. This was critical because it permitted us to map the inventoried capabilities against a generally accepted software pattern. In his book, *A Timeless Way of Building*, Christopher Alexander states that each pattern represents a decision that must be made and the corresponding considerations that go into that decision. From this model, service specifications were developed and mapped against an execution of the enterprise as a Service-Oriented Architecture (SOA).

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SOA expresses a software architectural concept that defines the use of services to support software users' requirements.

The DCGS-A Version 2 (V2) Baseline

The U.S. Army's Intelligence and Security Command (INSCOM) had developed a significant capability that enabled Soldiers advanced analysis capability through accessing a large number of databases and advanced analysis tools. The tremendous and insightful effort that allowed this to happen is described in another DCGS-A article in this magazine. The contribution and effort as a result of this development cannot be understated. Given that this development has been adequately covered, I will continue describing DCGS-A enterprise development.

DCGS-A V3 — Building An Enterprise

Based on previous work, V3 development was able to rapidly enhance the V2 system. To meet the pressing field requirements in Iraq, the information contained in the service specifications and user surveys needed to be quickly productized for delivery to the fight. The approach with the least risk was to take select high-value components highlighted in the POR survey and quickly make them ready to work in an enterprise context. This was accomplished by using two well-known enterprise architecture patterns defined earlier — the wrapper and adapter patterns.

The wrapper allows switching of implementations of application functions without impact to other communications partners by encapsulating (or transforming) messages in some fashion, typically XML. This is one component in implementing a loose coupling of an enterprise's elements.

PM DCGS-A's technological innovation has resulted in fielded ISR systems that benefit warfighters today and promise combatant commanders even greater intelligence analysis capabilities tomorrow. Here, SPC Timothy Foltz (left) and SSG Chris Bertomeu from Headquarters Co., 5th Battalion, 3rd Stryker BCT, 2nd Infantry Division, provide security during a joint patrol with Iraqi army soldiers near Salhea, Iraq, last November. (U.S. Army photo by SGT Antonieta Rico, 5th Mobile Public Affairs Detachment.)

The adapter seeks to place emulations or filters around or within business processes to affect the loose coupling's second half. The result of this was the first step in the DCGS-A implementation framework that formed the basis of all future development. We were very fortunate that INSCOM, with G-2 support, had created the enterprise's data warehouse portion called the "brain." This valuable contribution could not have been leveraged, however, had we not carefully followed the step-by-step operational plan illustrated earlier to transform legacy systems into an integrated enterprise context that permitted us to prepare and field a fully functional subset of the required DCGS-A components as DCGS-A V3.

The successful production so far of DCGS-A V3 would not have been possible without the use of a clear technical development methodology that permitted the aggregation of a broad range of software products and capabilities to be harnessed so that all available data could be made available to warfighters without temporal or geographic limitations.

Another key experience accrued from this process's execution was that we almost became victims of our success. The rapid and successful SOA-based integration of V2 into V3, followed by V3's fielding, left many feeling that we had reached the end state. While this operational capability is extraordinary, the enterprise target of having all the relevant information quickly available to the core users regardless of temporal or geographic location in a seamless fashion is still not complete. V3's success is just a step in the overall process to build on operational interoperability with NCES and full FCS functionality. Paraphrasing Winston Churchill, "it is the end of the beginning" and certainly not as far as we can go with the foundation we have built. Perhaps this is the most important process lesson.

We also reached out to other programs and agencies that were developing components that we could leverage. From the DOD DCGS community, we incorporated the U.S. Air Force-developed DIB to enhance Joint interoperability. We have been working with both the National Geospatial Agency and National Security Agency to be compliant with accessing their most available information and intelligence products and leveraging their most advanced developments. We are currently working with the Product Director for Intelligence Fusion to host the latest DCGS-A developments within the ASAS platforms.

DCGS-A V4 is now bringing enterprise capabilities to maturity as follows:

- ISR component to battle command.
- Actionable intelligence.
- Running estimates.
- Planning and collaboration capabilities.
- Modularity and scalability.
- Mobility/transportability.
- Distributed operation capability.
- Supports the Evaluation BCT.
- Provides full data access, including BCT sensors.
- Intelligence fusion.
- Net-centric compliance.
- NECC and interoperability.

The final lesson we learned is that it is important to keep the end state in mind. If not, it is easy to settle for intermediate success. The successful production so far of DCGS-A V3, and the imminent arrival this year of DCGS-A V4, would not have been possible without the use of a clear technical development methodology that permitted the aggregation of a broad range of software products and capabilities to be harnessed so that all available data could be made available to warfighters without temporal or geographic limitations. A key component — multiple source exploitation — which includes signals intelligence, geospatial intelligence, measurement and signals intelligence, ASAS and other open source intelligence-gathering capabilities, will help DCGS-A V4 achieve full POR capability. The use of a clearly directed capability inventory, best practices in the use of enterprise integration patterns and a solid data warehouse and application server framework has permitted us to field a system that is benefiting our warfighting customers every day and promises even greater capabilities tomorrow.

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